DOCUMENT RESUME

ED 393 414 IR 017 750

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TITLE Using Hypermedia To Turn University Teaching Inside Out.
PUB DATE 93
NOTE 6p.; In: Verbo-Visual Literacy: Understanding and Applying New Educational Communication Media Technologies. Selected Readings from the Symposium of the International Visual Literacy Association (Delphi, Greece, June 25-29, 1993); see IR 017 742. Contains some figures that may not reproduce clearly.
PUB TYPE Reports - Descriptive (141) -- Speeches/Conference Papers (150)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Classroom Environment; *College Instruction; Computer Uses in Education; Educational Technology; Foreign Countries; Higher Education; *Hypermedia; *Information Theory; Information Transfer; Instructional Innovation; *Models; Teaching Methods
IDENTIFIERS *Paradigm Shifts; *Postindustrial Society

ABSTRACT

The penetration of computer and telecommunications technology into daily life has resulted in a paradigm shift from an industrial to a post-industrial society. That has created a fourth "generation" of media--hypermedia--to go with the previous three of speech, print, and video. Hypermedia is said to be the only generation that is completely extrasomatic, or involving both storage and transmission of information that is outside of the human body. This paper offers several models to demonstrate this paradigm shift and the resulting changes in individuals' subjective orientations to the objective world. Hypermedia has great potential in helping society manage post-industrial complexity; therefore, it is coming into use in university teaching in lectures, seminars, and individual tutorials. The electronic blackboard created by hypermedia capabilities is neat and versatile and allows students to be listeners and scholars rather than mere note-takers. (Contains 13 figures.) (BEW)

USING HYPERMEDIA TO TURN UNIVERSITY TEACHING INSIDE OUT

by
W. Lambert Gardiner

Five Processes of Change

Innovations in computer technology, innovations in telecommunications technology, their convergence into informatics, and their penetration into society has resulted in a paradigmatic shift from an industrial society, based on energy, to a post-industrial society, based on information (see Figure 1). The revolution is over. Focus now shifts from "What's happening?" to "So what?" We now consider the implications of this shift for our various institutions. The major implication for my discipline of communication studies is that it introduces a fourth generation of media.

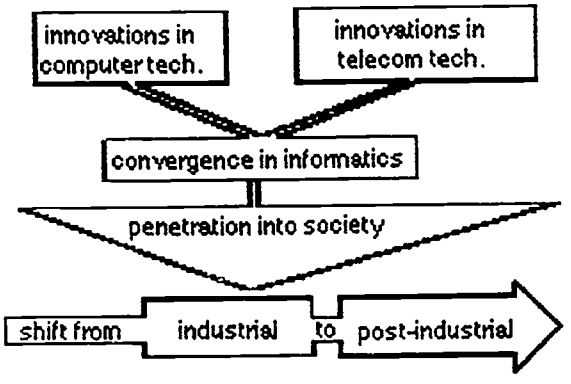

Figure 1 Five Processes of Change

Four Generations of Media

Carl Sagan (1977) classifies tools as extragenetic (that is, outside the genetic code but inside the body) or extrasomatic (that is, outside the body). Any medium involves use of tools for the storage and the transmission of information. Those two distinctions yield a two-by-two matrix, which can serve as a useful taxonomy of media (see Figure 2).

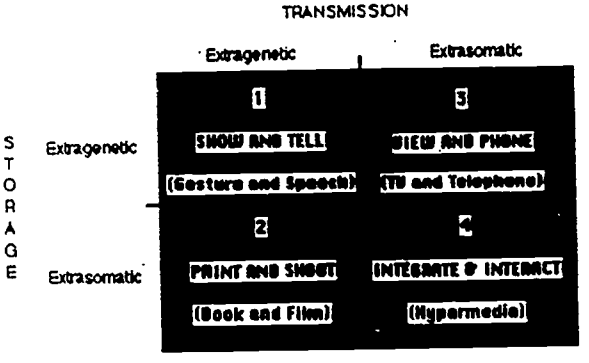

Figure 2 Four Generations of Media

In the first generation (speech), storage and transmission of information are both extragenetic; in the second (print), storage is extrasomatic; in the third (video), transmission is extrasomatic; and in this emerging fourth generation (hypermedia)--which completes the taxonomy--both storage and transmission are extrasomatic. Information is stored electronically in diskettes (floppy, hard, video, CD-ROM, etc.), and transmitted by the informatics infrastructure of a network of computer nodes linked by telecommunications. Whereas the second generation assists in the creation of a conceptual map of the objective world (verbo-literacy), and the third generation in the creation of a percep l map (visual literacy), this fourth generation enables us to integrate those maps (verbo-visual literacy).

Three Interfaces of Adam

Since the shift from an industrial to a post-industrial society is a structural rather than a sectorial shift, it is necessary to have a broad model to understand it. That is, a model which describes the whole society rather than simply some sector of it. The Three Interfaces of Adam is an attempt at such a broad model.

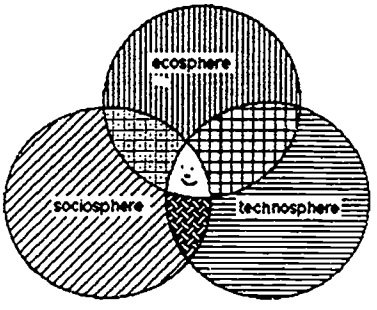

Figure 3
The Three Interfaces of Adam

The person could be considered as the triple overlap of three spheres--ecosphere, sociosphere, and technosphere ([Gardiner, 1987] see Figure 3). It is important that the environment be differentiated into the natural world (ecosphere), social world (sociosphere), and artificial world (technosphere), because, whereas the person is part of all three, the relationship between the person and each of the spheres is different. The person is the most complex system in the ecosphere, an element of the sociosphere, and the source of the technosphere. The study of the person in each of those spheres is therefore different. Person-in-ecosphere is the domain of the natural sciences, person-in-sociosphere is the domain of the social sciences, and person-in-technosphere is the domain of what Herbert Simon (1981) has called "the sciences of the artificial."

Two Hemispheres

Within each person in the center, there is a subjective map of the objective world (see Figure 4). We usually consider media as mediating between people. However, they can also be considered as mediating, within each person, between this subjective map and the objective world. The subjective map could be considered as composed of a perceptual map and a conceptual map, corresponding roughly to the thing and the word in the objective world and to text- and image-based media (see Figure 5). It is a useful metaphor to consider the perceptual map as a function of the right hemisphere and the conceptual map as a function of the left hemisphere.

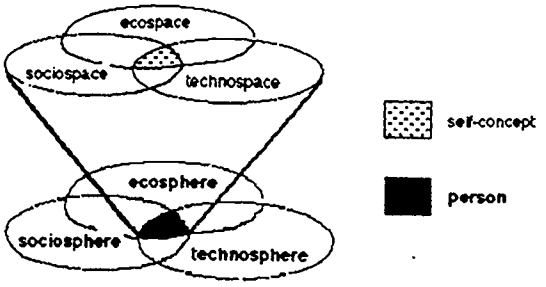

Figure 4 Objective World and Subjective Map

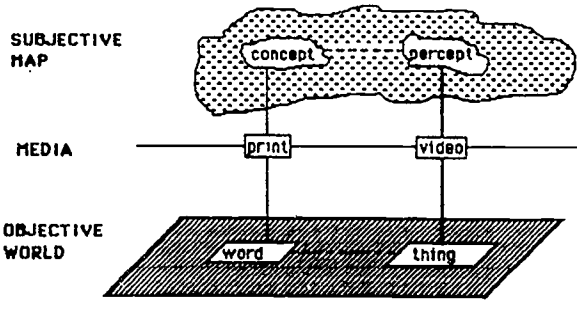

Figure 5
"Media"ting Between Subjective Map and Objective World

Some tasks are best performed by the left hemisphere and some by the right. We academics tend to privilege the left hemisphere. For example, it is obvious that recording directions given over the telephone lends itself best to the perceptual map. This has only become obvious to me, however, within the last year (partly as a result of thinking about those things). For example, look at Figure 6. On the left (for the left hemisphere), you see my attempt to record the directions to the house of my friend Sally written on 22 March, 1990; on the right (for the right

hemisphere), you see my attempt to record the directions again, drawn on 7 July, 1990--just over three months later. (In the interval, I had forgotten how to get there--partly because I had used my left hemisphere inappropriately.) The second strategy was superior--not only because I was able to get there with only one stop to glance at the map but also because I still remember how to get to Sally's place years later--the physical map has been etched in as a mental map. We have to learn to fire on all our cylinders.

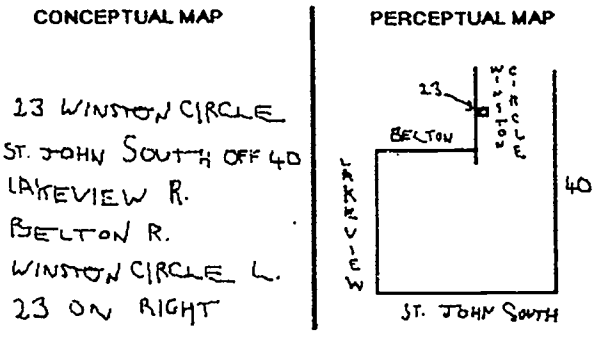

Figure 6
How to Get to Sally's Place

One Corpus Callosum

Within this metaphor, the computer could be considered as the corpus callosum. This captures the two basic characteristics of computer-based media--integration and interactivity. The corpus callosum links the two hemispheres, as the computer integrates text and image, and it may link the cerebral cortex with the rest of the body, as the computer provides interactivity between thought and action.

Now that we have the technology to simulate the entire nervous system, we can seriously consider mapping our subjective maps isomorphically on to the objective world. The structure of hypermedia--a network of interlinked nodes--is isomorphic with the structure of the mind--a network of interlinked concepts--and the structure of the informatics infrastructure--a network of computers interlinked with telecommunications (see Figure 7). It serves then as a positive prosthetic which fits.

A major problem of our post-industrial society is the management of complexity. Our rich information environment enables us to make a subtle subjective map of the objective world. The computer helps us manage this complexity. Just as the telescope brings the too-far near enough to observe and the microscope makes the too-small large enough to observe, so the computer makes the too-complex simple enough to observe.

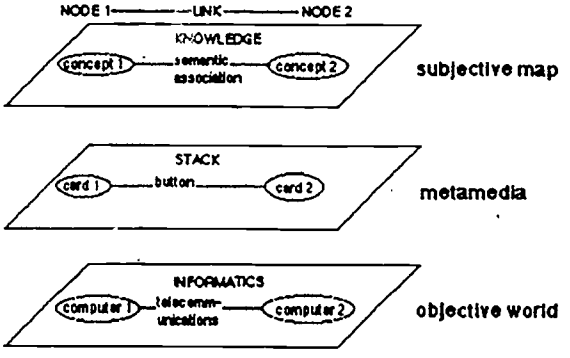

Figure 7
Isomorphism of Hypermedia

To do so, however, we must stop using it as a typewriter. It is necessary to go beyond word-processing (one-dimensional) to idea-processing (two-dimensional) to meta-media (three-dimensional). See Figure 8.

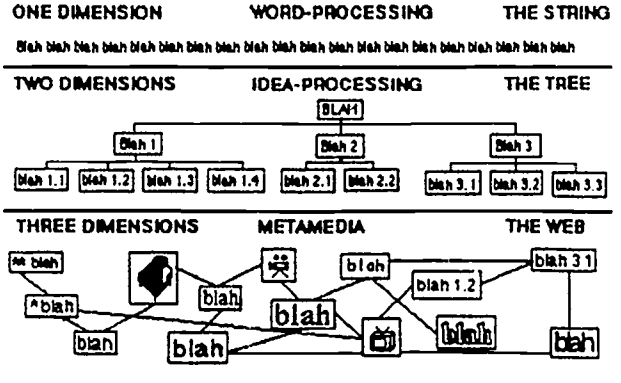

Figure 8
Three Dimensions of Computing

Hypermedia has incredible potential as a tool for teaching in the university, which has confined itself largely to the first two generations of media--talk and chalk. This paper describes the use of hypermedia by the author in his lectures, seminars, and tutorials.

The four communication settings in university are listed in Figure 9. Hypermedia simulates the fourth setting, which is the real-life situation of the student. He/she is dealing with information from many sources (various professors, parents, friends, media, and so on), impinging on a single destination. Let us look, in turn, at the use of hypermedia in each of the three other settings.

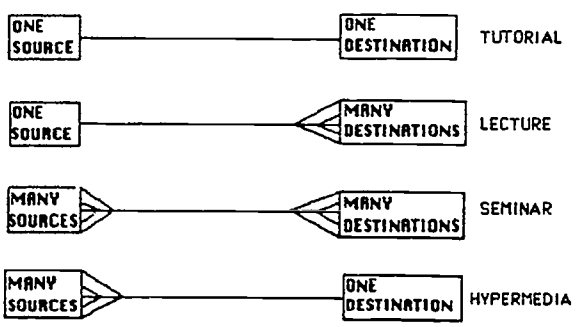

Figure 9 Four Communication Settings in the University

Hypermedia in Lectures

Before each of my classes, the students are given a handout which includes an outline of the presentation, the figures, and the references. This enables them to be scholars rather than secretaries. There is no need to feverishly make messy, inaccurate copies of my material. They are encouraged however to make, rather than take, notes on the content of the lecture.

The cards are projected on a screen using an electronic blackboard attached to the computer. This establishes a common visual space. The advantage of the electronic blackboard over the traditional blackboard, is that the material need not be laboriously and messily written and drawn, then rewritten and redrawn the following year. The advantage over the overhead projector with transparencies is fully appreciated only when animation is used. It is difficult to show 24 transparencies per second.

The handout is a hard copy of a Hypercard stack. A disk containing all the handouts in electronic form is given to any student who requests it. They are encouraged to use this stack as a *starter set* to which they add their own cards and links, and to use the computers in the university lab if they do not have one at home.

Hypermedia in Seminars

Despite those innovations, the setting is still teacher--rather than student--directed. This may be an inevitable feature of the lecture setting. It is still show biz. The innovations simply permit the teacher to put on a better show.

I have transferred a solarium in my electronic cottage into a Smart Room, which is my vision of the seminar room of the future (see Figures 10, 11). It differs from the traditional seminar room largely because it contains Caesar. This is a system for pulling information into the room from other computers over the modem, from CD-ROM discs, from videodiscs, from the hard disk, and so on (see Figure 12).

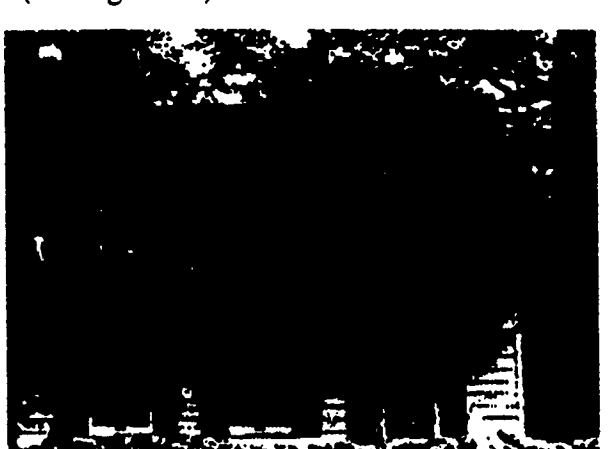

Figure 10 The Electronic Cottage

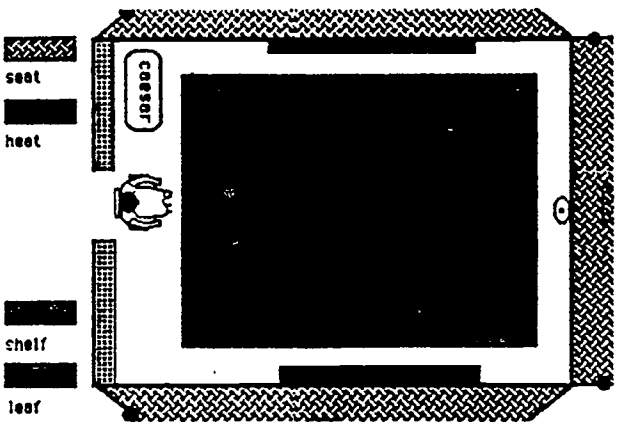

Figure 11 The Smart Room

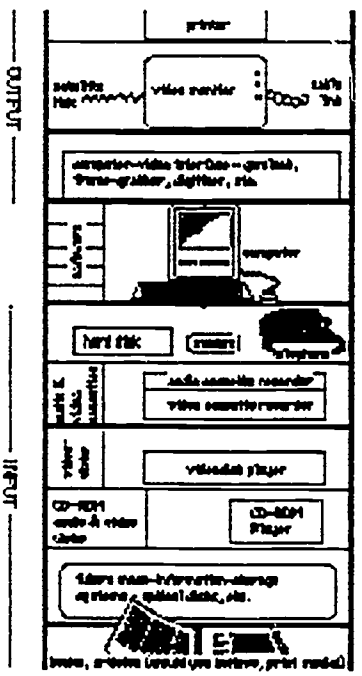

Figure 12 Caesar

Hypermedia in Tutorials

Whereas tutorials are the basis of university education at Oxbridge, they play a minor role in North America. Honors projects and directed studies are very minor (and unrewarded) aspects of teaching. Perhaps, now that we have electronic colleagues to do the outside-in information-providing aspect of teaching, tutorials could play a larger role, since the teacher has more time and energy for the inside out inspiration-creating aspect of teaching. The advantage of the tutorial is that the student chooses the topic, the professor, and directs the project. Unless they learn to do so, they will never become independent scholars. It is not by chance that Oxbridge has produced so many fine scholars.

When a student approaches me about a tutorial, I consult my colleague, Siliclone. This is a satellite brain containing all my favorite sources, notes, quotes, anecdotes ([Gardiner, 1987], see Figure 13). Rather than vaguely muttering the names of some possible sources, I print out the information in my siliclone which is relevant to his/her topic. This synergy between the person and the machine is an attempt to find some optimal orchestration of natural and artificial intelligence.

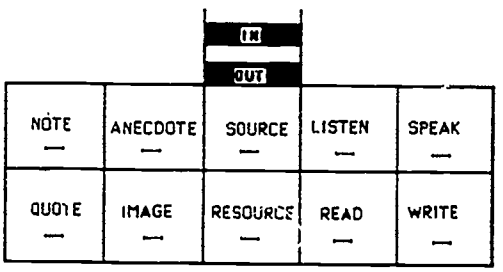

Figure 13 The Siliclone

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